Remarks

Applicant and the undersigned would like to thank the Examiner for her efforts in the examination of this application. Reconsideration is respectfully requested.

I. Objection to the Specification

The Examiner has objected to the Specification under 35 USC 112, first paragraph, for nonenablement.

To address these objections, the inventors have provided the following explanations:

1. This invention is for measuring the rate of respiration, in the form of CO_2 evolution, from a solid or liquid sample. It is very sensitive and only applicable for low levels of respiration rate in the range of 1 to 200 µL/h. The alkaline solution used in this invention has to be diluted in the concentration range of mM or sub-mM level.

2. We agree that shaking changes the CO_2 evolution rate from a carbonated solution such as soda. This invention, however, is not for measuring carbonated water. It is for measuring respiration rate (e.g., microbial respiration) in solid and/or liquid samples such as milk or wastewater. Shaking helps to homogenize a liquid sample and get a reproducible rate of respiration in the form of CO_2 evolution.

3. The shaking speed in this invention is not changing; it is held at a constant speed (around 250 rpm) throughout the measurement.

4. Shaking also helps to homogenize the diluted alkaline solution in the process of absorbing CO_2.

5. CO_2 evolution from a sample and CO_2 absorption by a diluted alkaline solution are, indeed, two separate processes, as the Examiner has correctly pointed out. We agree that the word "equilibrium" used in the previous claims should have been "steady state." That is, a steady state is established when the rate of CO_2 evolution from a sample equals the rate of CO_2 absorption by the alkaline solution. At this steady state, the CO_2 concentration in the headspace of the device of this invention becomes constant.

6. A "pre-incubation" (previously called pre-equilibrium) step is required in this invention to establish a steady state, in which the CO_2 concentration of the headspace becomes constant, before the measurement step. The minimum time required to establish the steady state is illustrated in FIG. 5. The y-axis in FIG. 5 is the head space CO_2 concentration expressed as the percentage of the final (i.e., steady-state) headspace CO_2 concentration. For example, if the final steady-state headspace CO_2 concentration is 60 ppm and the initial head space CO_2 concentration is 360 ppm (ambient air), the y-axis value is 600%. As the time of pre-incubation increases, the y-axis value decreases until it becomes 100% when the final steady state is established.

7. After a steady state is established, the larger amount of alkaline solution is withdrawn and replaced with a smaller increment of the fresh alkaline solution. The time required for the CO_2 to consume the alkaline solution is signaled by the color of the indicator. This time interval is used, along with the concentration of the alkaline solution, to calculate the CO_2 absorption rate of the alkaline solution, which happens to be the same as the CO_2 production rate of the sample in a steady state.

It is hoped that these explanations and amendments to the Specification are sufficient to overcome the Examiner's objections thereto.

IV. Rejection of Claims 1-13 under 35 USC 103(a)

The Examiner has rejected Claims 1-13 under 35 USC 103(a) as being unpatentable over Baker et al. (Abstract, 1999) in view of Harp (US 6,368,870).

This rejection is respectfully traversed. Baker et al. and Harp are different from the invention claimed herein in that Baker uses equilibrium vapor to determine the CO_2 concentration in a sample. There is no recitation in the claims of determining CO_2 concentration as taught by Baker. The invention as claimed determines the respiration rate of a sample directly, which Baker cannot.

Harp determines the carbon content of a sample, while this invention as claimed recites the determination of the respiration rate of a sample. Harp cannot be used to determine respiration rate, because it requires exhaustive absorption of CO_2 in the headspace by the alkaline solution. The CO_2 in the enclosed space of the present invention as claimed can never be exhaustively absorbed by the alkaline solution because the CO_2 is continuously produced by a sample, and because there is a limited rate of CO_2 absorption by the dilute alkaline solution. In fact, there is a substantially constant CO_2 level in the enclosed space of the present invention after the steady state is established, by definition.

Therefore, it is respectfully believed that the present Claims 1-13 patentably define over the cited art.

Conclusions

Applicants respectfully submit that the above amendments place this application in a condition for allowance, and passage to issue is respectfully solicited. The Applicants and the undersigned would like to again thank the Examiner for her efforts in the examination of this application and for reconsideration of the claims as amended in light of the arguments presented. If the further prosecution of the application can be facilitated through telephone interview between the Examiner and the undersigned, the Examiner is requested to telephone the undersigned at the Examiner's convenience.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that the foregoing is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, this 16th day of March, 2005.

Lynnette Dewitz

In the Drawing:

Please enter replacement drawing sheet 3/3, wherein the abscissa of FIG. 5 has been amended.